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SUMMARY OF 1952 EXPERIMENTS FOR THE CONTROL OF INSECTS AND MITES AFFECTING CROPS IN YUMA COUNTY, ARIZONA

by

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FOREWORD

This is a *progress report* of research being conducted by the University of Arizona Agricultural Experiment Station in cooperation with the Yuma County Office of the University of Arizona Agricultural Extension Service, the United States Department of Agriculture, the Yuma County Farm Bureau, and interested individuals and groups in Yuma County. Since the information developed to date has immediate practical application it is made available before the completion of the research. The indicated results are not necessarily final interpretations and are not intended as recommendations. Interested growers should consult official control recommendations issued by the University of Arizona Agricultural Extension Service, through local County Agents, for assistance in meeting their particular insect and mite control problems.

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American Cyanamid Company
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Mathieson Chemical Corporation
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Niagara Chemical Division, Food Machinery and Chemical Corporation
Rohm and Haas Company
Shell Chemical Corporation
Stauffer Chemical Company
Taylor Farm Supply Company
Velsicol Corporation
Yuma County Farmers Marketing Assn.

TWO SPOTTED SPIDER MITE CONTROL ON CANTALOUPES

The two-spotted spider mite, Tetranychus bimaculatus Harvey, was less important in 1952 as a pest of cantaloupes than in 1951. Although a number of fields were treated with various miticides early in the 1952 season most of these applications were probably needless. In many cases fields became infested by the migration of mites from nearby alfalfa. It appears that the proper control of mites early in the season in alfalfa and along ditches could do much to reduce later infestations in nearby melon fields. A number of formulations of miticides were tested against the two-spotted spider mite on cantaloupes during the spring of 1952. The principal results are summarized in the three following tables. Tests were made by D. M. Tuttle.

Summary of Results of a Mite Control Test on Cantaloupes at the Stewart-Warner Ranch, Yuma Valley, Arizona, May-June, 1952.

	Per cent Reduction in Mites Following Treatments as Compared With Untreated Areas.[1] (Reductions in Mite Eggs Shown in Parentheses) Days After Treatment		
	3	7[2]	15
Sprays: (1 quart of emulsion concentrate applied per acre in 8 gallons of water at 60 pounds pressure, using a Yellow Devil Sprayer, May 28).			
25% Aramite	83.9 (80.4)	78.8 (86.7)	74.3 (48.3)
25% Ovotran	94.1 (94.5)	91.4 (92.7)	84.7 (50.8)
25% Geigy 338	69.3 (73.2)	71.5 (74.1)	76.9 (56.4)
85% NPD (du Pont)	32.5 (25.1)	90.0 (95.2)	48.3 (4.1)
25% Dimite (DMC)	61.9 (89.6)	76.5 (89.7)	58.6 (8.1)
Dusts: (Applied at the rate of 40 lbs. per acre, using a Hardie tractor-mounted duster, May 28, 1952).			
3% Aramite	35.9 (70.1)	68.1 (83.7)	85.7 (2.8)
10% Ovotran	0.0 (0.0)	42.9 (0.0)	68.3 (66.0)
5% Malathon	88.9 (57.9)	71.1 (65.2)	56.3 (0.0)
10% Sulphenone 212	65.7 (30.7)	0.0 (0.0)	27.5 (11.5)
10% Sulphenone 213[3]	85.2 (43.2)	72.2 (64.2)	66.8 (15.4)
7½% Ovotran plus 1% Para.	56.3 (3.2)	64.4 (0.0)	64.1 (60.6)
1% Parathion	29.6 (0.0)	0.0 (0.0)	3.1 (0.0)
2% Metacide	39.9 (0.0)	0.0 (0.0)	37.4 (0.0)

[1] Records based on counts of individual mites and eggs on 20 leaves, representing 5 leaves from each of 4 replicated plots.

[2] Records from dusted plots were taken 8 days after application.

[3] Also contains 1% parathion.

Summary of a Test of Miticide Dusts on Cantaloupes at the Ranch of McDaniel and Sons, Inc., Yuma Valley, Arizona, April-June, 1952

Dust Treatments April 29 and May 6	No. of Applications	Pounds Per Acre 2/	Per Cent Reduction in Mites Following Treatments as Compared with Untreated Areas.1/ (Reductions in Mite Eggs Shown in Parentheses) May 2	May 9	June 18
3% Aramite	1	62	87.5 (3.7)	96.6 (99.5)	67.9 (100.0)
	2	62,52	61.1 (0.0)	100.0 (96.3)	96.4 (100.0)
7½% Ovotran	1	50	45.8 (0.0)	100.0 (70.9)	85.7 (100.0)
	2	50,48	63.9 (0.0)	99.1 (56.2)	89.3 (100.0)
1% Parathion	1	46	98.6 (27.2)	92.3 (84.0)	0.0 (0.0)
	2	46,42	88.9 (66.9)	100.0 (93.4)	39.3 (83.3)
7½% Ovotran plus 1% Parathion	1	46	80.6 (0.0)	100.0 (100.0)	0.0 (0.0)
	2	46,42	100.0 (0.0)	100.0 (92.1)	10.7 (0.0)
5% Malathon	1	55	29.2 (0.0)	84.2 (69.2)	0.0 (0.0)
	2	55,50	22.2 (0.0)	87.7 (79.6)	0.0 (0.0)
3% Metacide	1	46	65.3 (0.0)	73.6 (84.7)	0.0 (0.0)
	2	46,42	95.8 (0.0)	99.7 (87.4)	100.0 (100.0)

1/ Records based on counts of individual mites and eggs on 20 leaves, representing 5 leaves from each of 4 replicated plots.

2/ A single number denotes an application made on April 29; two numbers denote applications made on April 29 and May 6. Dusts were applied with a Hudson hand-operated, rotary duster.

Summary of a Test of Miticide Sprays on Cantaloupes at the Ranch of McDaniel and Sons, Inc., Yuma Valley, Arizona, May-June, 1952.

Data by D. M. Tuttle.

Spray Treatments May 2 and 9	Amount Per 100 Gal. Spray	No. of Applications 1/	Per Cent Reduction in Mites Following Treatments as Compared with Untreated Areas. 2/ (Reductions in mite eggs shown in parentheses) May 6	May 13	June 19
25% Aramite emul. conc.	2 qts.	1	68.2 (12.2)	81.4 (86.4)	91.7 (75.9)
		2	51.3 (8.5)	89.3 (91.5)	76.9 (75.9)
25% Ovotran emul. conc.	2 qts.	1	35.9 (44.2)	92.6 (87.3)	11.6 (0.0)
		2	39.4 (0.0)	97.9 (94.)	
45% Parathion emul. conc.	1 qt.	1	92.7 (72.9)	97.1 (99.1)	0.0 (0.0)
		2	90.7 (13.8)	98.5 (98.3)	54.6 (27.6)
50% Metacide emul. conc.	1 qt.	1	84.3 (47.9)	87.6 (96.0)	26.5 (75.9)
		2	89.2 (0.0)	88.3 (93.7)	27.3 (6.9)
25% Geigy 338 emul. conc.	2 qts.	1	93.0 (55.3)	98.2 (94.5)	37.2 (0.0)
		2	44.0 (50.5)	96.4 (97.6)	85.1 (79.3)
50% Malathon emul. conc.	2 qts.	1	50.7 (77.1)	86.1 (86.1)	0.0 (0.0)
		2	89.5 (27.1)	87.6 (85.5)	0.0 (0.0)
42% Systox emul. conc.	1 qt.	1	85.4 (85.6)	99.7 (100.0)	100.0 (100.0)
		2	89.5 (42.5)	100.0 (99.9)	99.2 (100.0)
50% Ovotran wettable powder	1½ lbs.	1 3/	- -	80.4 (60.2)	95.1 (100.0)
25% Aramite wettable powder	2 lbs.	1 3/	- -	0.0 (4.9)	12.2 (58.3)
25% Geigy 338 wettable powder	2 lbs.	1 3/	- -	95.1 (91.3)	36.6 (0.0)

1/ Plots receiving one application of emulsifiable concentrates were sprayed on May 2; plots receiving two applications were sprayed on May 2 and May 9. Plots were sprayed with a Hudson hand-operated compressed air sprayer.

2/ Records based on counts of individual mites and eggs on 20 leaves, representing 5 leaves from each of 4 replicates.

3/ Single applications of sprays from wettable powders were made on May 9.

In evaluating the various materials used for the control of the two-spotted spider mite on cantaloupes satisfactory control was usually obtained with 3% Aramite dust, 25% Aramite emulsion sprays, 7½% Ovotran dust, 25% Ovotran emulsion sprays and (in a single test) a spray made from a 50% Ovotran wettable powder. Other materials which gave good to promising control were Parathion dusts, Geigy 338 emulsion, Malathon dusts, a combined 7½%-Ovotran and 1% Parathion dust, Sulphenone 213 (containing 10% Sulphenone and 1% Parathion), and duPont NPD. Single applications of Parathion and Metacide were effective for a few days, although 2 applications at 5- to 6-day intervals were needed for sustained mite control. This same tendency was observed with Malathon. The most effective material tested was Systox, an organic phosphate material with systemic action, which cannot yet be recommended for use because of serious hazards which require further investigation.

TWO-SPOTTED MITE CONTROL TESTS ON ALFALFA

Infestations of the two-spotted mite, Tetranychus bimaculatus Harvey, were found in most alfalfa fields in the Yuma area in 1952, although the actual crop damage was apparently less widespread than in 1951. In one case where mite webbing and serious crop damage were present the heavy mite infestation was probably due to a combination of high humidity and an application of DDT plus toxaphene which affected insect predators of the mites.

Systox applied at the rate of 1 to 1½ pints per acre by either air or ground machinery gave the best control of the two-spotted mite on alfalfa. Good control for 14 to 16 days was obtained with Aramite, using either the 3% dust or the 25% emulsion (2 pints per acre). Equally effective in various tests were 7½% and 10% Ovotran dusts, applied at the rate of 35 lbs. per acre, and 25% Ovotran emulsion (2 pints per acre). Excellent initial kills resulted from the use of 2% Parathion dust and 45% Parathion emulsion (1 pint per acre) but reinfestations occurred in approximately 6 days. Thereafter, unless checked by a second application, the mites in the parathion plots increased rapidly due to the absence of predators. Within two weeks, the numbers of mites equalled or exceeded those present in untreated areas. When 7½% Ovotran and 1% Parathion dusts were combined the mite control compared favorably with that produced by Aramite and produced a residual action extending over a 21-day period. Other miticides which showed promise when tested on alfalfa were Geigy 338 and Malathon. Sulfur had little or no effect on the two-spotted spider mite during May or June but gave good control during July and August when temperatures were higher and greater volatilization occurred.

Alfalfa seed yields were taken in two mite and insect control experiments. The highest yields were taken from plots in which mites had been controlled. Plots dusted two and three times with Aramite produced 129 lbs. more seed than the untreated plots. Plots receiving 10% Ovotran dust and 7½% Ovotran plus 1% Parathion dust produced yields 92 and 98 pounds higher, respectively, than untreated plots. In a second test Aramite-treated plots yielded about 50 lbs. more seed per acre than plots where mites were not well controlled.

The effect of insecticides and miticides applied to alfalfa upon insect predators was evaluated in each 1952 experiment. The entire problem is very complex and will require a considerable amount of further investigation. It may be said from the work done in 1952 that some of the chemicals used are more selective than others in "killing off" useful insects. A number of observations have demonstrated the importance of predators and parasites in controlling mites and insects with or without the aid of chemical control. Results of the more important 1952 mite control tests on alfalfa are summarized in the tables on the following pages.

Summary of Results of a Mite Control Test on Alfalfa at the Earl Stark Ranch, Yuma Mesa, Arizona, April 1952.

Treatments: (Applied by Plane, April 4, 1952)

	7½% Ovotran Dust 1/	7½% Ovotran plus 1% Parathion Dust 2/	7½% Ovotran plus 98% Sulfur Dust 2/	98% Sulfur Dust 1/	25% Aramite Emulsion 3/	Untreated Check
	Relative Abundance of 2-Spotted Spider Mites 4/					
April 3 (pre-count)	3.1	3.1	3.1	3.1	3.1	3.1
April 7	1.9	1.1	2.3	3.0	1.8	3.7
April 10	2.0	1.6	2.0	2.6	2.0	3.6
April 16	3.4	1.2	2.9	3.1	2.5	2.6
April 28	1.3	1.1	2.8	3.8	2.8	3.7

Data by D. M. Tuttle, A. R. Face, and Frank Pritchard.
Airplane applications made by courtesy of Spain Flying Service.

1/ Application rate 35 lbs. per acre.

2/ Each material applied separately at the rate of 35 lbs. per acre.

3/ Application rate ½ lb. of toxicant per acre.

4/ Mite abundance was measured by the numbers present on the lower 5 basal leaves of 25 alfalfa stems selected at random from each plot. The degree of infestation was expressed by the following index:

A rating of	1	denotes an average of 0 - 5 mites per stem
	2	5 - 10
	3	10 - 15
	4	over 15

Summary of Results of a Test of 99% Sulfur Dust Applied to Alfalfa at 3 Rates of Application for the Control of the 2-Spotted Spider Mite at the Earl Stark Ranch, Yuma Mesa, Arizona, May-June, 1952.

Date 1952	Days After Last Sulfur Application	Per Cent Reduction in Mites Following Treatments as Compared With Untreated Areas. 1/ (Reductions in mite eggs shown in parentheses) Pounds of 99% Sulfur Dust Applied Per Acre on May 4 and June 20, 1952. 2/		
		44	88	132
May 5	1	29.4 (0.0)	65.0 (21.4)	65.7 (8.3)
May 7	3	0.0 (0.0)	80.3 (77.5)	74.0 (75.8)
May 17	13	11.6 (18.8)	42.8 (11.9)	83.8 (61.6)
June 11	25	0.0 (0.0)	15.8 (0.0)	56.7 (0.0)
June 23	3	20.9 (40.3)	80.6 (81.4)	90.0 (81.2)

1/ Data are based on counts of 200 alfalfa stems per date per treatment, in which the 5 lower basal leaves of 10 stems from each of 4 replicates were examined.

2/ Applications were made with a Hardie tractor-mounted duster. Plots receiving 88 and 132 pounds of sulfur were dusted two and three times, respectively, on each application date.

Data by D. M. Tuttle.

Summary of Results of a Test of Various Miticides Applied As Emulsions for the Control of the 2-Spotted Spider Mite on Alfalfa at the Earl Stark Ranch, Yuma Mesa, Arizona, May-June, 1952.

Material Used[1] (Emulsifiable Concentrates)	Pints of Toxicant Applied Per Acre	Per Cent Reduction in Mites Following Treatments as Compared with Untreated Areas[2] (Reductions in mite eggs shown in parentheses)		
		Days After Treatment		
		5	10	15
42% Systox	1	97.0 (93.3)	99.0 (98.0)	98.4 (98.2)
85% NPD (duPont)	1	92.4 (90.9)	77.1 (91.0)	10.1 (0.0)
45% Parathion	1½	89.8 (96.8)	71.9 (88.0)	4.4 (0.0)
50% Metacide	1	87.5 (94.7)	81.4 (96.3)	31.5 (0.0)
25% Dimite (DMC)	2	85.1 (91.4)	72.5 (75.3)	60.8 (15.6)
25% Geigy 338	2	83.7 (83.7)	76.1 (80.7)	62.8 (44.1)
25% Aramite	2	80.0 (89.1)	70.8 (90.0)	51.4 (0.0)
82% Gen. Chem. 876	2	65.5 (73.8)	80.9 (88.3)	25.9 (0.0)
25% Ovotran	2	64.8 (76.2)	72.4 (66.0)	1.2 (0.0)
50% Malathon	2	61.6 (92.0)	50.5 (63.5)	0.0 (0.0)
25% Dilan	2	52.1 (72.8)	0.0 (43.7)	0.0 (0.0)

[1] Applications were made May 24, 1952, using a Yellow Devil tractor-mounted sprayer. The concentrates were applied in 8 gallons of water per acre at a pressure of 60 lbs.

[2] Data are based on counts of 200 alfalfa stems per date per treatment, including the 5 lower basal leaves of 10 stems from each of 4 replicates.

Data by D. M. Tuttle.

Summary of Results of a Test of Various Miticides Applied as Dusts for the Control of the 2-Spotted Spider Mite on Alfalfa at the Earl Stark Ranch, Yuma Mesa, Arizona, April-July, 1952.

Dust Treatments 1/ and rates per acre for applications on April 28, May 4 and June 20, respectively	Per cent Reduction in Mites Following Treatments as Compared with Untreated Areas 2/ (Reductions in Mite Eggs Shown in Parentheses)					Seed Yield July 21 Lbs. per acre 3/
	May 1	May 7	May 17	June 11	June 23	
99% Sulfur (44#, 42#, 40#)	10.2 (34.1)	0.0 (41.5)	44.3 (18.8)	0.0 (0.0)	20.9 (40.3)	633 (1.1)
10% Ovotran (47#, 42#, 43#)	45.6 (46.3)	92.4 (63.2)	99.4 (99.9)	83.4 (63.5)	87.0 (35.2)	718 (14.7)
7½% Ovotran plus 1% Parathion (41#, 40#, 38#)	62.2 (48.0)	97.9 (84.7)	99.6 (100.0)	64.6 (17.4)	84.9 (64.0)	724 (15.6)
10% Ovotran plus 50% Sulfur (37#, 36#, 38#)	6.9 (41.6)	49.6 (19.4)	94.6 (93.3)	50.5 (13.7)	11.8 (17.6)	674 (7.7)
1% Parathion (47#, 45#, 42#)	78.9 (53.7)	87.1 (85.0)	98.0 (99.3)	0.0 (0.0)	69.3 (69.0)	665 (6.2)
3% Aramite (40#, 41#, 40#)	91.7 (60.3)	100.0 (96.2)	78.5 (98.7)	84.3 (63.5)	84.4 (71.4)	755 (20.6)
3% Metacide (44#, 41#, 39#)	72.0 (58.8)	79.7 (78.3)	94.6 (98.2)	0.0 (0.0)	55.3 (43.8)	779 (24.4)

1/ Applications made with a Hardie tractor-mounted duster.

2/ Data are based on counts of 200 alfalfa stems per date per treatment, including the 5 lower basal leaves of 10 stems from each of 4 replicates.

3/ Yields are expressed in pounds of cleaned seed per acre. For each dust treatment the per cent increase in yield as compared with untreated areas is indicated in parenthesis.

Data by D. M. Tuttle.

Summary of Results of a Test of Spray and Dust Formulations for the Control of the 2-Spotted Spider Mite, Lygus Bugs, and Bollworms on Alfalfa at the Hugh Johnston Ranch, Yuma Mesa, Arizona, July-August, 1952. Materials applied July 2-4, 1952.

	Insecticides Used				
	Sprays[1] (@ 8 gallons per acre)		Dusts[3] (@ 30 pounds per acre)		
	42% Systex Emulsion @ 1½ pts./a.	Toxaphene-Sulphenone Emulsions [2]	20% Toxaphene 40% Sulfur	20% Toxaphene 3% Aramite [4]	20% Toxaphene 10% Ovotran 50% Sulfur [5]
Mites per 100 alfalfa stems (mite egg counts in parentheses):					
July 12	33 (8)	176 (95)	4 (0)	0 (2)	1 (0)
19	43 (43)	491 (310)	0 (0)	15 (10)	5 (2)
26	136 (158)	1714 (1177)	28 (23)	31 (39)	38 (46)
Lygus Bugs per 200 Net Sweeps (nymph counts shown in parentheses):					
July 2 (pre count)	160 (316)	160 (316)	160 (316)	160 (316)	160 (316)
July 4	21 (125)	5 (1)	2 (1)	2 (1)	2 (0)
10	45 (0)	8 (0)	1 (0)	1 (0)	1 (0)
17	39 (0)	27 (0)	25 (0)	29 (0)	23 (0)
25	49 (23)	32 (0)	41 (0)	51 (0)	48 (0)
28	28 (12)	19 (0)	21 (0)	26 (0)	23 (0)
Bollworms per 100 Net Sweeps:					
July 2 (pre count)	7	7	7	7	7
July 4	12	4	0	0	1
10	13	7	5	1	4
17	53	64	79	47	71
25	32	43	55	76	68
28	0	0	0	0	0
Yield Data (Pounds of Cleaned Seed per Acre):					
Aug. 10	412	400	412	442	395

See next sheet for footnotes.

1/ Sprays were applied with a tractor-mounted Yellow Devil sprayer. The water emulsions were applied at the rate of 8 gallons per acre at 60 lbs. pressure.

2/ Six pounds of toxaphene and one pound of Sulphenone were applied per acre.

3/ Dusts were applied with a tractor-mounted Hardie duster.

4/ 20% toxaphene dust and 30% Aramite dust were separately applied to the same plots at the rate of 30 lbs. per acre.

5/ 20% toxaphene dust and a dust containing 10% Ovotran plus 50% sulfur were separately applied to the same plots at the rate of 30 lbs. per acre.

Summary of a Test Comparing a Dust Mixture of Aramite and Sulfur With Dusts Containing Each Material Alone, Against the Two-Spotted Spider Mite on Alfalfa, at the Hugh Johnston Ranch, Yuma Mesa, Arizona, September-October, 1952

(Note: Rumors from unverified sources have indicated that dusts containing Aramite and sulfur together were less effective against mites than were dusts containing Aramite alone. It will be noted that this was not the case in this particular experiment. Alfalfa samples from the Aramite-dusted plots were collected for chemical analysis of residues on September 17 and 24, and on October 3 and 13. A report of these analyses is not yet available.)

Dusts Applied @ 30 lbs. per acre, Sept. 16, using a Hardie tractor-mounted duster:	Per Cent Reduction in Mites Following Treatments as Compared with Untreated Areas 1/ (Reductions in Mite Eggs Shown in Parentheses)			
	Days After Treatment			
	5	10	18	30
3% Aramite plus 70% Sulfur	98.2 (100.0)	100.0 (100.0)	99.4 (98.2)	96.5 (94.3)
99% Sulfur	100.0 (99.4)	93.5 (95.9)	96.8 (92.9)	89.1 (89.6)
3% Aramite	92.9 (99.4)	94.1 (84.7)	91.2 (90.0)	85.6 (90.7)

1/ Each record is based on counts of 150 leaves, representing the 5 basal leaves of 10 stems selected at random from each of 3 replicates.

Data by D. M. Tuttle.

EFFECTS OF IRRIGATION UPON THE ABUNDANCE OF THE 2-SPOTTED SPIDER MITE ON ALFALFA

The relative effects of three rates of irrigation (dry, medium, and wet) upon alfalfa plant growth and upon infestations of mites and insects were observed in a test conducted at the Yuma Valley Farm of the University of Arizona in cooperation with the farm staff. Plots receiving the dryest schedule received no irrigations after March 28, 1952. The medium schedule provided for irrigations at 3-week intervals and the wet schedule provided for irrigations at 10-day intervals. To correlate insect and mite activity with alfalfa plant development weekly measurements were made of plant height, stem length, number, size, and area of leaves, numbers of green buds, racemes, green pods, dry pods, and other variables.

Mite development varied between plots receiving dry, medium, and wet irrigation schedules. For example, on July 15, at the time of the last observations, the mite populations were zero, 11, and 38 individuals, respectively, for the above schedules. Even more pronounced was the effect of a dieldrin spray on June 4, followed by a DDT spray on June 13, upon the numbers of mites present on July 15. These sprayed plots contained 8, 119, and 147 mites per 100 leaflets following the dry, medium, and wet irrigation schedules, respectively. In the sprayed plots receiving the wet schedule successive weekly counts between June 24 and July 15 showed 5, 17, 64, and 147 mites per 100 leaflets, respectively.

These observations were made by George D. Butler, Jr., and were a continuation of similar work begun in 1951. A detailed account of a 2-season study of the effects of moisture and other factors on the abundance and crop injury of the 2-spotted spider mite on alfalfa is being prepared for publication in an early issue of the Journal of Economic Entomology.

OBSERVATIONS OF THE CLOVER MITE ON ALFALFA

The clover mite, Bryobia praetiosa Koch, is a large, dark-colored mite found on the upper surfaces of alfalfa leaves from February until early April in the Yuma area. Occasional serious damage to alfalfa has been observed. Most of these mites are located near the ground level and eggs are frequently deposited on old alfalfa stems which have collected near the bases of the live plants. This mite is dormant during the warmer months of the year.

Three experiments were conducted for the control of the clover mite in alfalfa fields on the Yuma Mesa which had suffered a considerable amount of injury. The most promising of the materials tested against this mite were 3% Aramite dust and an Aramite emulsion spray applied at the rate of one pound of actual toxicant per acre. Parathion dust gave a high initial kill of mites although, after a single application, infestations within two weeks were as heavy as in untreated areas. It was indicated that a second application within a week after the first treatment, to kill individuals hatching from unaffected eggs, is necessary when parathion is used. Ten per cent Ovotran dust was slightly less effective than 3% Aramite dust against this mite in the 1952 tests. A 99% sulfur dust was relatively ineffective when applied at the rate of 40 lbs. per acre, probably because of the lower volatility of sulfur during the cooler months of the year.

PEA APHID CONTROL ON ALFALFA

The pea aphid, Macrosiphum pisi (Kltb.) was common on alfalfa during the spring of 1952. A number of heavily-infested fields were observed although in most cases the aphids were held reasonably in check by lady beetles, syrphid fly larvae, and other natural enemies. One test of insecticides for the control of this insect was conducted at the Yuma Valley Farm of the University of Arizona. Insecticides were applied with hand-operated equipment to plots 24 feet square, replicated three times. Immediately before the applications were made on April 23 the aphid populations averaged 1260 individuals per 30 net sweeps. Sprays were applied at the rate of 50 gallons per acre and dusts were applied at the rate of 35 pounds per acre. The results of this test, which was made by D. M. Tuttle, are summarized below. Aphid populations are expressed as the numbers of aphids per 30 net sweeps, representing 10 sweeps from each of the 3 replicates of each treatment.

	Period after treatment			
	2 days		5 days	
	no. of aphids	per cent control	no. of aphids	per cent control
1% Parathion dust	2	99.8	5	99.8
45% Parathion emulsion[1/]	2	99.8	14	99.0
50% Metacide emulsion[1/]	3	99.7	8	99.6
42% Systox emulsion [1/]	4	99.7	3	99.9
50% Malathon emulsion[2/]	20	98.5	295	86.0
25% DDT emulsion[2/]	108	92.0	278	87.5
40% TEPP emulsion[2/]	139	89.4	179	92.0
4% Nicotine dust	404	65.6	740	66.7
4.5% DDT emulsion[3/]	961	28.8	820	63.1
Untreated	1350	----	2220	----

1/ Concentration: 1 pint per 100 gallons of water.
2/ " : 1 quart " " " " "
3/ " : 1 gallon " " " " "

At the end of five days there were a few aphids with wings in the plots treated with parathion, Metacide, and Systox, indicating a migration into these plots from other areas. After nineteen days aphid counts in all plots were greatly reduced. This may be attributed to warmer temperatures unfavorable for aphid development. For this reason there is usually no problem with the pea aphid on alfalfa in the Yuma area after the middle of May.

EGYPTIAN WEEVIL ON ALFALFA

The Egyptian weevil, Hypera brunneipennis (Boh.), caused some early season damage to alfalfa terminal growth in the Yuma Valley although no cases were seen where the damage was serious enough to warrant the use of insecticides. At present no control problem seems to exist in fields where alfalfa is cut for hay. Early insecticidal applications indicated that the following materials were effective in controlling the Egyptian weevil: DDT sprays and dusts, toxaphene sprays and dusts, methoxychlor spray, and benzene hexachloride dust.

LYGUS BUGS ON ALFALFA

Lygus bugs (Lygus elisus Van D., L. hesperus Knight, and L. oblineatus Say) are among the most serious pests of alfalfa in the Yuma area. Although these bugs are present during the entire growing season they are most numerous and injurious during July and August, when as many as 5 to 8 bugs may be obtained in a single net stroke in alfalfa fields. Damage to hay crops is not particularly noticeable between February and May although after that time Lygus damage is most evident and serious. The feeding of these insects on terminal plant growth results in blasted buds and a general stunting of the entire plant. The feeding of adults on green pods also causes an appreciable seed loss.

In a series of tests at the Hugh Johnston Ranch on the Yuma Mesa excellent Lygus bug control resulted from 20% toxaphene dust applied at the rate of 30 lbs. per acre and from 60% toxaphene emulsion applied at the rate of 6 lbs. per acre in a water spray, using either ground or air equipment. Other tests gave equally good control when toxaphene emulsion was used at the rate of 3 lbs. per acre. Good control of Lygus nymphs was obtained with dusts containing 5% allethrin, and 5% Rohm and Haas Q-137. Other materials that gave promising results against Lygus bugs were aldrin, dieldrin, and isodrin (Compound 711). In two alfalfa fields the Lygus bugs were present at the rate of 3 to 7 individuals per net sweep and the plants were stunted and unable to bloom. In plots where Lygus bugs were controlled the plants bloomed in approximately 10 days, but no blooms were present in the untreated areas, which then contained an average of 5 to 8 bugs per net sweep. Observations in 1952 indicated that alfalfa fields properly protected from Lygus bugs during July and August might escape to some extent the annual "growth lapse" usually expected during these months.

CLOVER SEED CHALCID ON ALFALFA

The clover seed chalcid, Brucophagus gibbus (Boh.), is one of the most serious pests of alfalfa grown for seed in the Yuma area. Adult chalcids are not abundant in alfalfa fields until the blossoms and first small buds appear. Seed harvested before July 10 escaped serious injury from this pest in 1952. After this date, when alfalfa pods in most fields are maturing over a period of several weeks, the chalcids become more abundant and serious damage occurred.

Chalcid control during the period in which the second seasonal alfalfa seed crop is matured is particularly difficult because of the short life cycle of the pest and the enormous numbers of adults present. Repeated weekly dustings with DDT were relatively ineffective. Two per cent dieldrin dust was slightly more effective in reducing the numbers of chalcids, with a residual effect lasting for 5 to 6 days. Crop sanitation seems to offer the best means yet known for combatting this pest. This involves the prompt disposal of uncut alfalfa along field borders, to prevent the development of volunteer seeds, and the treatment of uncleaned seed and screenings to prevent the chalcids from carrying over from one season to the next.

BOLLWORM, OR CORN EARWORM, ON ALFALFA

During 1952 it was generally observed that the Bollworm, or corn earworm, Heliothis armigera (Hbn.), was numerous in alfalfa fields in the Yuma area when the green pods were partially matured. Infestations of one or two worms per net sweep appeared to justify the use of insecticides because of the large numbers of pods destroyed by the larger individuals. The use of a 5% DDT dust or a 25% DDT water emulsion spray, applied at the rate of one pound of actual DDT per acre, was 100% effective in 1952 when either ground or air equipment were used.

THREE-CORNERED ALFALFA HOPPER

The three-cornered alfalfa hopper, Stictocephala festina (Say), injures alfalfa by feeding on plant juices and by weakening the stems near the ground with egg punctures and girdling. Few of the insecticides tested during the 1952 season were completely effective in controlling this insect. The best results were obtained with 5% malathon dust and with 25% malathon emulsion sprays. Both formulations gave control efficiencies of 90% or better. These malathon applications were also effective in reducing the leafhopper populations which were so numerous on alfalfa during the late summer. It was indicated in preliminary observations that parathion emulsion sprays may be effective against the three-cornered alfalfa hopper.

THE "ALFALFA LEAFROLLER"

During the late summer of 1952 the terminals of alfalfa plants growing in the Yuma area were commonly infested with a leafroller, Platynota sultana (Walsingham). (This insect is a minor pest of citrus and has also been reported attacking celery in the Phoenix area). The female moths lay masses of 12-24 elongated eggs in irregularly double rows on the upper surfaces of the leaves of alfalfa terminals. The larvae "tie" the terminal leaves together to form protected areas in which to feed and develop. As a result the plant growth is stunted and blossoming is inhibited. The larvae in the "webs" are difficult to control, particularly when they reach the last two instars of development.

Of the various materials tested against this insect the best results were obtained with 10% DDT dust or 20% toxaphene dust, applied at the rate of 25 lbs. per acre, and with a 60% toxaphene emulsion applied at the rate of 3 lbs. per acre in a water spray. Some control was also obtained with Rohm and Haas

Compound Q-137, both as a 5% dust and as a 25% emulsion in a water spray. It should be noted that 10% DDT dust gave a control efficiency of only 50% against the older larvae. Between August 25 and September 5 it was found that from 5 to 10 per cent of the leafroller larvae were infested with hymenopterous parasites. The identity of the parasites has not yet been determined.

STINK BUGS ON ALFALFA

Three species of stink bugs have been commonly reported on alfalfa in Arizona: the brown stink bug, Euschistus impectiventris Stal., the Say stink bug, Chlorochroa sayi Stal., and the red-shouldered stink bug, Thyanta custator (Fabr.). None of these species were abundant on alfalfa or on other crops commonly grown in the Yuma area during 1952. No important control tests were carried out because of the low populations. In one instance, however, it was noted that stink bug populations were substantially reduced in alfalfa plots which were sprayed with Systox, at the rate of one pint of toxicant per acre, for the control of mites. Specimens of a small hymenopterous egg parasite, Telenomus sp., were reared from several stink bug egg masses collected from alfalfa.

THE ALFALFA CATERPILLAR

The larvae of this common yellow butterfly, Colias philodice eurytheme Bdvl., did not appear in numbers in the Yuma area until late August and early September 1952. No extensive tests were possible against this ordinarily important pest of alfalfa although larvae were easily controlled with DDT either as a 5% dust at 20 lbs. per acre or as 25% emulsion spray at the rate of one pound of actual DDT per acre.

INSECTICIDE RESIDUE STUDIES ON ALFALFA

In August 1952 an experiment was begun by Dr. Lemac Hopkins designed to determine the persistence of insecticide residues on alfalfa and the effect of Arizona weather conditions in accelerating the disappearance of toxic materials applied to foliage. This work was done in the Yuma area. The following materials were applied to alfalfa plots with ground equipment using both dust and spray formulations:

Toxaphene	endrin (compound 269)
DDT	isodrin (compound 711)
parathion	Rohm and Haas compound Q-137
malathon	chlordane
dieldrin	heptachlor
DDT plus dieldrin	allethrin
aldrin	

Alfalfa samples were collected immediately after applications were made and at approximately weekly intervals until the time of cutting. The results of the various residue analyses are not yet available and will be reported by Dr. Hopkins at a later date.

MISCELLANEOUS OBSERVATIONS DURING 1952

No detailed experiments were made during most of the season against insects and mites affecting cotton in the Yuma area, although the seasonal progress of infestations and control practices was noted. During October two dust formulations and four spray applications were applied by plane for the control of the cotton aphid, Aphis gossypii Glov., on the Robert Moody Farm in the Yuma Valley. Complete control for at least two weeks followed applications, at 25 lbs. per acre, of a dust containing 2% gamma benzene hexachloride, 5% DDT, and 50% sulfur and a dust containing 5% malathon. Equally good control was obtained following the application, at the rate of 8 gallons per acre, of a 50% malathon emulsion spray containing 1 lb. of malathon per acre and a benzene hexachloride-toxaphene emulsion spray containing 0.3 lb. gamma benzene hexachloride and 3 lbs. of toxaphene per acre. Good but less than perfect control followed the use of a spray emulsion containing 0.3 lb. gamma benzene hexachloride and 1 lb. of technical DDT per acre and a spray containing 1.5 pints of 40% TEPP per acre.

Darkling beetles and ants were numerous in most alfalfa fields in the Yuma area in 1952. The importance of these insects as enemies of alfalfa is not well understood and should be further investigated. Large numbers of these insects were killed by applications of chlordane and heptachlor during the course of other experiments.

A number of insect pests of citrus were observed in the Yuma area during 1952 although none was of serious importance except the citrus thrips, Scirtothrips citri (Moulton), which was controlled with a 25% DDT emulsion spray (using 1 lb. of actual DDT per 100 gallons) and with a sabadilla spray (2-4 lbs. of ground sabadilla seed and an equal quantity of sugar per 100 gallons of water). An infestation of the cottony cushion scale, Icerya purchasi Mask., on grapefruit was satisfactorily controlled by the predatory valdalia bettle, Rhodolia cardinalis (Muls.). A light infestation of the soft scale, Coccus hesperidium L., on orange stems was controlled by destroying the attending ants with 5% chlordane dust placed in rings on the soil around nearby nest openings.

Infestations of skipper larvae, Atalopedes campestris (Bdvl.), were found injuring bermuda grass lawns and the bent grass greens of the Yuma Country Club. These larvae were effectively destroyed with emulsion sprays containing either chlordane, DDT, or aldrin.

Houseflies and small gnats in buildings were effectively controlled with a space spray containing a new pyrethrum-type insecticide base (McLaughlin Gormley King Formula 1184-B) diluted with seven parts of light mineral oil or kerosene. This mixture was effectively applied with an electric Microsol machine provided through the courtesy of the Indianhead Manufacturing Company. Flies of several species in a dairy cattle feed lot were effectively attracted and destroyed in large numbers by a mixture of 50% malathon emulsion and milk, to which water was periodically added. This work will be reported later in detail.